

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
3 June 2004 (03.06.2004)

PCT

(10) International Publication Number  
**WO 2004/047030 A3**

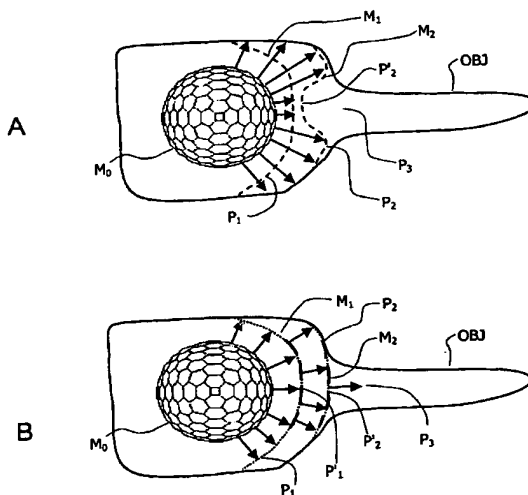
- (51) International Patent Classification<sup>7</sup>: **G06T 5/00**, 17/20 (74) Agent: **LOTTIN, Claudine**; Société Civile SPID, 156 Boulevard Haussmann, F-75008 Paris (FR).
- (21) International Application Number: PCT/IB2003/005168 (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (22) International Filing Date: 14 November 2003 (14.11.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 02292884.0 20 November 2002 (20.11.2002) EP
- (71) Applicant (*for all designated States except US*): **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): **FRADKIN, Maxim** [IL/FR]; 156 Boulevard Haussmann, F-75008 Paris (FR). **ROUET, Jean-Michel** [FR/FR]; 156 Boulevard Haussmann, F-75008 PARIS (FR). **MAKRAM-EBEID, Shérif** [FR/FR]; 156 Boulevard Haussmann, F-75008 PARIS (FR).
- (84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Declaration under Rule 4.17:**

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,

[Continued on next page]

(54) Title: IMAGE PROCESSING SYSTEM FOR AUTOMATIC ADAPTATION OF A 3-D MESH MODEL ONTO A 3-D SURFACE OF AN OBJECT



(57) Abstract: An image processing system having means of automatic adaptation of 3-D surface Model to image features, for Model-based image segmentation, comprising: dynamic adaptation means for adapting the Model resolution to image features including locally setting higher resolution when reliable image features are found and setting lower resolution in the opposite case. This system comprises estimation means for estimating a feature confidence parameter for each image feature. The model resolution is locally adapted according to said parameter. The feature confidence parameter depends on the feature distance and on the estimation of quality of this feature including estimation of noise. The large distances and the noisy, although close features are penalized. The resolution of the Model is decreased in absence of confidence and is gradually increased with the rise of feature confidence.

WO 2004/047030 A3



KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:  
7 October 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

## INTERNATIONAL SEARCH REPORT

International Application No.  
PCT/EP 03/05168A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 G06T5/00 G06T17/20

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DELINGETTE H: "General object reconstruction based on simplex meshes" INT. J. COMPUT. VIS. (NETHERLANDS), INTERNATIONAL JOURNAL OF COMPUTER VISION, 1999, KLUWER ACADEMIC PUBLISHERS, NETHERLANDS, vol. 32, no. 2, August 1999 (1999-08), pages 111-142, XP002289618 ISSN: 0920-5691 page 131, left-hand column, line 5 - line 10  ----- -/--	1-15

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \* & \* document member of the same patent family

Date of the actual completion of the international search

23 July 2004

Date of mailing of the international search report

10/08/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Werling, A

## INTERNATIONAL SEARCH REPORT

International Application No

P B 03/05168

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	PEKAR V ET AL: "SHAPE MODEL BASED ADAPTATION OF 3-D DEFORMABLE MESHES FOR SEGMENTATION OF MEDICAL IMAGES" PROCEEDINGS OF THE SPIE, SPIE, BELLINGHAM, VA, US, vol. 4322, 19 February 2001 (2001-02-19), pages 281-289, XP008020236 ISSN: 0277-786X abstract introduction sec. 2.3, "Local mesh refinement" page 283 - page 284	1-15
A	DELINGETTE H ED - INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS: "SIMPLEX MESHES: A GENERAL REPRESENTATION FOR 3D SHAPE RECONSTRUCTION" PROCEEDINGS OF THE COMPUTER SOCIETY CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION. SEATTLE, JUNE 21 - 23, 1994, LOS ALAMITOS, IEEE COMP. SOC. PRESS, US, 21 June 1994 (1994-06-21), pages 856-859, XP000515947 ISBN: 0-8186-5827-4 cited in the application the whole document	1-15
A	WO 02/073536 A (PHILIPS CORP INTELLECTUAL PTY ; KONINKL PHILIPS ELECTRONICS NV (NL)) 19 September 2002 (2002-09-19) abstract	1-15

BEST AVAILABLE COPY

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/JP03/05168

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 02073536	A	19-09-2002	DE 10111661 A1	12-09-2002
			EP 1251462 A2	23-10-2002
			EP 1371013 A2	17-12-2003
			WO 02073536 A2	19-09-2002
			JP 2002329216 A	15-11-2002
			US 2002184470 A1	05-12-2002
			US 2003020714 A1	30-01-2003

BEST AVAILABLE COPY